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Newsletter of the

Hawaiian Botanical Society

Volume 37 Number 1 *May, 1998*

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Eriophyid Mite Galls on Lama and Other Hawaiian Plants

Donald E. Gardner

Pacific Island Ecosystems Research Center, USGS Biological Resources Division, Department of Botany, University of Hawai'i at Manoa, Honolulu, HI 96822

Among the plant abnormalities most frequently noticed and brought to my attention for identification or comment by interested observers in the field is a conspicuous gall-like growth on the branches of lama (*Diospyros* spp.; family Ebenaceae), Hawai'i's native persimmon (Wagner et al., 1990). The fleshy galls are often large, measuring 15 cm in diameter or more, and consist of many irregular small lobes on the surface, which give the superficial appearance of a head of cabbage or broccoli. Many such growths may occur in a single tree. Fresh galls are often reddish green in color, and become dry and gray with age. They persist and remain conspicuous in the tree. These growths somewhat resemble the fleshy witches'-brooms associated with some of Hawai'i's rust fungi. However, instead of resulting from a fungal pathogen, the galls consist of plant tissue stimulated to abnormal development by a feeding toxin injected by eriophyid mites. Members of this specialized group of plant-feeding mites are distinct from other types of mites more familiar to most gardeners and greenhouse keepers. The "typical" mite is usually considered to resemble a miniature spider, that has a round or oval-shaped body, eight legs, and produces webs. Predatory mites are noticeable by their rapid movements. In contrast, eriophyid mites are small, measuring about 0.1 mm in length. As such, they appear small even when viewed with a hand lens. Furthermore, they are sedentary, remaining motionless or nearly so much of the time while feeding, and moving slowly when changing positions. Thus, they are easily overlooked unless one knows what to look for. The body is light-colored and elongate, resembling a drawn-out water droplet in

Continued on page 3

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Published by the Hawaiian Botanical Society which was founded in 1924 to...

> *...advance the science of botany in all its applications, encourage research in botany in all its phases, promote the welfare of its members and develop the spirit of good fellowship and cooperation among them."*

Any person interested in the plant life of the Hawaiian Islands is eligible for membership. Information may be obtained from the Society at:

c/o Department of Botany
3190 Maile Way
University of Hawai'i
Honolulu, HI 96822

MEMBERSHIP

The Society year is from December 1 through November 30

Membership	Cost per year
Individual	$10.00
Student	$5.00
Family	$12.00
Life (individuals only)	$180.00

Honorary and Life Members pay no further dues.

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Continued from page 1

shape. These mites have two pairs of small legs, rather than the four pairs of most arachnids, and are all located at the broadened end of the body. Eriophyid mites may move from plant to plant by air currents. Mites are present, often in large numbers, only as long as the tissue remains fresh. Unfortunately, the galls frequently collected for identification are often older, and it is not possible to demonstrate their cause since mites are no longer present.

The long-term, physiological effect on the development of plant tissue caused by the feeding toxin distinguishes the activity of eriophyid mites from the direct mechanical feeding injury associated with chewing insects, for example. These criteria justify consideration of the gall-like abnormalities as symptoms of a true plant disease. However, other than the immediate production of the growths, there appears to be little negative effect on the plant itself, although to my knowledge this has received no specific study.

Eriophyid mites also produce abnormal growths on leaves of other native plants, among the most conspicuous of which is on *Broussaisia arguta* (kanawao), a member the Hydrangeaceae (Wagner et al., 1990). Fresh galls are brown and fuzzy in surface texture and are termed "erinea" (singular: erineum).

Fig. 1. Eriophyid mite gall on lama.

They may be large enough to affect most of the leaf tissue, which becomes thickened and distorted. Like growth abnormalities associated with eriophyid mites on lama, galls on *Broussaisia* resemble the fungus-caused rust diseases of certain plants, especially the species of koa rust that produces powdery brown galls on leaf or phyllode surfaces of koa. As described above, the sedentary light-colored, water droplet-shaped mites may be found only in fresh galls, where they can be seen by careful examination with a hand lens among the hair-like projections of the gall surface. Little is known concerning the host-specificity of the eriophyid mites associated with growth abnormalities of native plants, although they are thought to be host specific. If this is the case, mites associated with endemic hosts such as lama and kanawao may themselves be endemic. This consideration is significant in the formulation of resource management policies for natural areas regarding the control of organisms, such as mites, which are usually considered pests.

Cultivated plants, such as ornamental hibiscus, particularly the Chinese red hibiscus (*Hibiscus rosa-sinensis*) popular with gardeners and homeowners, become affected by a similar mite, referred to as the hibiscus erineum mite (Koob, 1998). Damage to the plant is visible as leaf, stem and twig galls, sometimes congregated in groups, which give the tissue an unsightly appearance. On close examination, the galls appear fuzzy in surface texture and mites may be seen under a hand lens associated with fresh galls. The lychee tree (*Litchi chinensis*) is another cultivated species on which similar fuzzy galls caused by erineum mites are prominent and frequently observed.

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Smut Disease of Pili Grass in Hawai'i

Donald E. Gardner
Pacific Island Ecosystems Research Center, USGS Biological Resources Division and Department of Botany, University of Hawai'i at Manoa, Honolulu, HI 96822

and

Curtis C. Daehler
Department of Botany, University of Hawaii at Manoa, Honolulu, HI 96822

Pili grass (*Heteropogon contortus*), also known as twisted beardgrass or tanglehead, is widely distributed throughout the tropics, and occurs in Hawai'i as an indigenous species or possibly a Polynesian introduction. It occupies dry habitats on rocky cliffs or slopes, from sea level to 700 m elevation on all of the main islands, but populations have declined in recent decades (Wagner et al., 1990; Daehler and Carino, in press). A disease, pili smut, has long been known to occur on pili grass in Hawai'i (Carpenter, 1919; Raabe et al., 1981), but appears to have been observed more frequently in recent years. As implied by the name, the disease is caused by a member of the specialized group of plant pathogens commonly known as smut fungi. Infection is systemic, but obvious symptoms of the disease are limited to the seed head, where the normally uniform, linear arrangement of the spikelets is disrupted and the floral parts are spread out at irregular angles. The seed head itself also may be stunted and does not produce viable seeds. The normal tissue of the florets is replaced by a mass of powdery, black spores which are easily rubbed onto the fingers and other objects. Microscopically, the spores (teliospores or teleutospores) are spherical, with a rather thick, ornamented cell wall, and measure 8–14 μm in diameter.

The fungus causing pili grass smut has undergone a number of taxonomic revisions. In his publication Hawaiian Fungi, Stevens (1925) reported this smut in Hawai'i as *Sphacelotheca monilifera*, a name also used by Fischer (1953) in his manual of smut fungi. In listing the known smut fungi of Hawai'i, Mäkinen (1969) referred to this species as *Ustilago monilifera*, which was one of four smut fungi he considered native to Hawai'i. Since *H. contortus* is widely distributed, and the smut fungus was most likely introduced to Hawai'i with its host, Mäkinen undoubtedly intended the smut to be considered indigenous rather than endemic. More recently, the concepts of these genera have been narrowed, with the placement of this fungus in the revived genus *Sporisorium* (Vánky, 1994). Vánky recognizes two species of *Sporisorium* on *Heteropogon*: *S. contortum*, which is rare and has smaller spores, and *S. caledonicum*, which is more common and has larger spores. The type specimen of *S. caledonicum* is recorded on *H. contortus* from the island of New Caledonia. We have found only this species in Hawai'i to date, but a thorough microscopic examination of spores has not been undertaken.

Rust and smut fungi are often considered to be closely allied with one another and to cause similar types of plant diseases. They are therefore sometimes confused, as they may be in this case since a rust fungus (*Puccinia versicolor*) is also known to occur on pili grass in Hawai'I (Gardner and Hodges, 1989). Rust diseases are most frequently apparent on vegetative portions of the host, that is, the leaves or stems, where they may be quite conspicuous. On the other hand, smuts typically are associated with the flowering parts of the host. Many smut fungi undergo intricate developmental cycles that are closely synchronized with the growth and development of the host itself, beginning with germination of seed-borne spores, which systemically infect internal tissues of the developing plant.

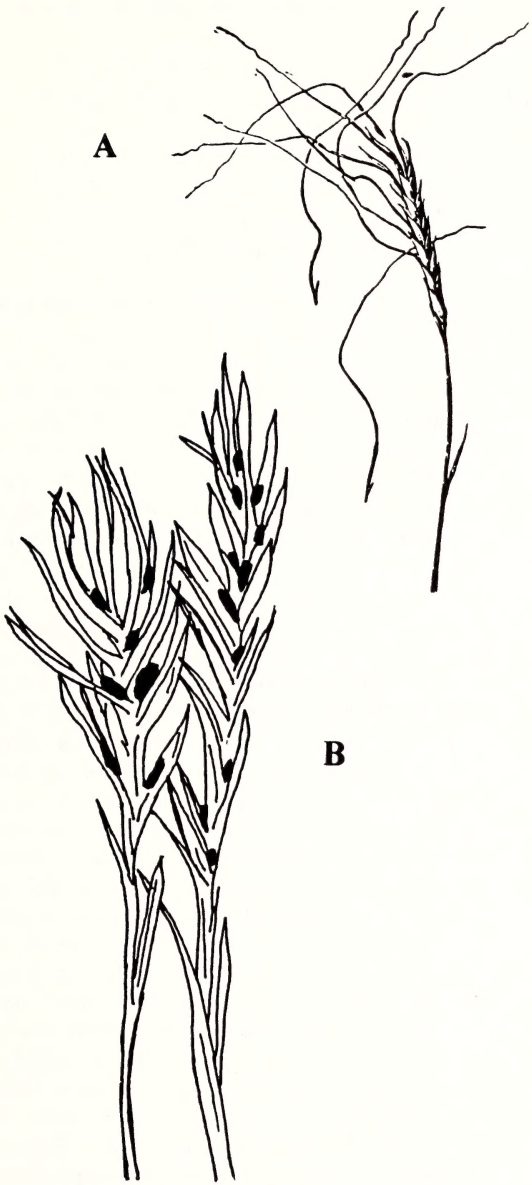

Fig. 1. Pili grass, *Heteropogon contortus*. A. Healthy inflorescence (from Hitchcock, 1950). B. Smut infested inflorescence.

Infected plants frequently show no sign of infection until they produce flowers. At this time, as illustrated by pili smut, the disease becomes apparent with the production of dark masses of wind-borne spores in the place of the flower tissue. The effect of the disease therefore is to destroy the reproductive capability of the host. Although no studies have been conducted to assess the impact of the smut on pili grass populations in Hawai'i, Wagner et al. (1990) state that "Pili appears to be rapidly diminishing in some areas, especially on O'ahu and Moloka'i." It is not beyond reason that the subtle reduction of reproductive capability caused by this disease contributes to this decline.

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Growing Native

Alvin Yoshinaga
Center for Conservation Research and Training,
University of Hawai'i at Manoa, Honolulu, Hawaii 96822

With this issue of the Newsletter, the Native Plant Committee begins a regular column on native plant horticulture. The main goal of the column will be to spread previously unpublished information about growing native plants.

We welcome anyone wishing to share such information to send it to the Society, or contact any of the members of the Native Plant Committee. There are no format or style restrictions; anything from one sentence to several paragraphs is appropriate. We do recommend listing both scientific and common names of plants and giving an address and telephone number at which readers can contact you for more information. Below are two entries that suggested as a model that others might adopt:

I. Fast Germination of Koa Seeds

To speed germination of koa (*Acacia koa*) seeds, first measure a volume of seeds and put them into a pyrex container. Pour 3-4 times that volume of boiling hot water onto the seeds and let them soak overnight. Seeds will start germinating in approximately two weeks when sown on damp pottinq medium or kept between damp paper towels. *NOTE:* To avoid cooking the seeds, don't use too much hot water.

II. Separating Small Seeds From Fleshy Fruits

Growers wishing to obtain clean seeds from fleshy fruits can try several methods:

1. Paper Towel Method: Smear the pulp onto a paper towel in a very thin layer. After the pulp is completely dry, you can scrape the seeds loose. This method works well for small quantities. (Tested for *Clermontia kakeana* [*'ohawai*].)

2. Sock Method: Mash the fruit in an old sock and rinse. If you choose a sock of the right material, you can rinse the pulp free, and the seeds will remain in the sock. (Tested for *Touchardia latifolia* [*olona*].)

3. Blender Method: This method, though more involved than the others, is more efficient for separating large quantities of seeds. Place the pulp in a kitchen blender with water. Blend at medium speed until the pulp is completely pureed. Pour the puree into a measuring cup. Swirl the cup to place the puree into suspension, then pour the suspension carefully into another container and set it aside. Slow down when the measuring cup is nearly empty; most of the seeds will remain at the bottom of the cup. If you now add more water and repeat this once or twice, you can pour away most of the pulp. Rinse the seeds out from the cup with water and pour them onto a coffee filter. You can dry the seeds quickly by tying the top of the filter with a twist tie then hanging the filter on a fan. (Do not use heat - it will reduce the viability of the seeds.) Repeat the process with the puree you set aside during the first pouring. If too many seeds still remain in suspension, thin the puree with water. (Tested for several fleshy-fruited lobeliads and olona; also works well for *Hedyotis terminalis* [*manono*] and Broussaisia arguta [*kanawao*], if

the mixture is sieved after blending to separate seed capsule fragments from the seeds.)

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Treasurer's Report
January to December 1997

Due to diligent fundraising efforts and benevolent member donations, the Society finished 1997 with about four hundred dollars surplus for the year. Such welcome news is tempered once again however, by realizing our biggest expense, the Newsletter, shipped only three new issues in 1997. So again, while we may need revnue adjustments once the Newsletter gathers a full head of steam, 1997 was a good year for the Society.

In other news, the Society's bank account was acquired by American Savings Bank from Bank of America. The story is still unfolding as this report is being written, but it is expected there will be a new account number and new checks sometime in 1998.

Finally, the treasurer would like to thank Wisteria Loeffler for her thorough financial audit of the Society's books for 1996.

1997 Receipts and Expenses Summary

Income		Outgo	
CD Principal	$2,540.00	CD Principal	$3,090.00
Total Dues	1,756.00	Copying	876.86
Donations	619.00	Postage	585.40
Garage Sale	422.65	Pre-grad Grant	562.22
Pre-grad Grant	500.00	Science Fair	262.70
Plant Raffle	169.00	Stationary	25.53
CD Interest	73.08	**Total Outgo**	**5,402.71**
Interest	53.67		
Earth Day	15.00		
Total Income	**$6,149.20**		

Beginning Balance + Income - Outgo = Ending Balance

$2,734.18 + $6,149.20 - 5,402.71 = $3,480.67

The net gain for 1997 is $386.49, which does not include 1997 life memberships or unrealized interest in the Life Member Fund (see below).

1997 Dues Received Summary

Student	19 x 1 yr.	$95.00
	2 x 2 yr.	20.00
Individual	69 x 1 yr.	690.00
	6 x 2 yr.	120.00
Adjustment	2 x $2.50	5.00
Family	16 x 1 yr.	192.00
	1 x 2 yr.	24.00
Institutional	10 x 1 yr.	200.00
	1 x 2 yr.	40.00
Obsolete rate	1 x 1 yr.	10.00
Annual Dues subtotal		$1,396.00
Life members		360.00
Dues Total for 1997		**$1,756.00**

The 1997 life memberships are not included in the 1997 net gain reported above.

Life Member Fund Summary

This section is a new feature of the Annual Report. For accounting purposes from now on, the Life Member Fund (LMF) will be treated as a separate account and its annual activity will be reported here, not in the Receipts and Expenses Summary.

In review, the 1995 Annual Report proposed to set aside life member's dues in a separate account. At the time, there were 37 life members, good for $5,550.00 when assessed dues at $150.00 apiece. Of course, the treasury didn't have this much to space, so about half the working capital, $2,000.00, was anted up and annual $500.00 payments were proposed until the $3,550.00 shortfall was covered. The Society opened a six month certificate of deposit account with the money, allowing biannual review and deposits. This

practice continues today. New life memberships automatically go here. Presented below is a summary of this account's activity from inception:

Beginning Principal		$2,000.00
Life Members	1996 (3)	$540.00
	1997 (2)	$360.00
Annual Payment	1996	$0.00
	1997	$250.00
Interest	1996	$59.04
	1997	$162.75
Donation		$300

At the beginning of 1997, the account held $2,540.00, which consisted of the beginning principal and 1996 life memberships. In mid-1997 the account held $3,090.00, which consisted of the previous $2,540.00 plus the 1997 annual payment and the donation. At years end 1997, the account holds $3,179.67, which consists of the previous $3,090.00 plus $89.67 in unrealized interest, discussed below. Several adjustments will be made at the next biannual review. The 1997 life memberships will be deposited, an annual payment will be made, and the donation will be split, half stays here and half goes to the Neal-Miller Fund.

All of 1996 interest and the first half of 1997 interest, $73.08, went back into the Society's checking account and is reported in annual Receipts and Expenses Summaries. Interest from the second half of 1997, $89.67, remains with this account and is noted here, since it is not reported in either the Receipts and Expenses Summary or in the net gain. Since the Society hasn't quite kept pace with projected $500.00 annual payments, by leaving interest in the LMF unrealized like this, the Society makes at least a partial annual payment, painlessly.

Leaving behind painless topics, over time the Society naturally loses life members. The target sum owed the LMF from pre-1996 life memberships decreases accordingly. The Society has, so far, lost just one of 37 pre-1996 life members. with our loss, the target sum decreases from $5,500.00 to $5,400.00. Combining this revised figure with $900.00 from five new life members added since 1996 means the LMF should contain $6,300.00. As previously stated, at year's end 1997 the LMF contains $3,179.67.

Respectfully Submitted,

Ron Fenstemacher

Ron Fenstemacher, Treasurer

Minutes of the Hawaiian Botanical Society

January Meeting

- The January 12, 1998 meeting of the Hawaiian Botanical Society was called to order by Mindy Wilkenson, President.

- The minutes were approved as read.

- **Treasurer's Report.** Ron Fenstemacher, Treasurer, reported $3467.96 in the Society's account. A request for an auditor was put forth, and Vickie Caraway volunteered.

- **Membership Report.** Gerald Toyomura, Membership Chair, reported that the Botanical Society's current membership is 197; 104 members are current, 93 have not yet renewed their membership for 1998.

- **Conservation Committee.** Steve Mont-gomery, committee chair, announced that the committee needs a new chair as well as new members.

- **Grants Committee.** Priscilla Millen, committee chair, announced that new members are needed to assist her in giving grants to students studying native plants.

- **Old Business**
  - There was no old business to discuss.

- **New Business**
  - Steve Montgomery requested that the Society consider donating money to assist in the creation of a poster with a Hawaiian ethics theme.

  - Aaron Lowe announced that Bill Garnett had been injured in a hiking accident, and a Get Well card was passed around. Vickie Caraway made a motion to send flowers to Bill, and the membership approved.

  - Announcments included the availability of Hawaii Horticulture, a new newsletter created by Greg Koob and available free at m garden shops on Oahu; Keith Robinson has made *Solanum* seeds available to anyone who sends him a stamped and addressed envelope; a vegetative key to Hawaii's grasses will soon be available.

- **The Plant of the Month,** *Urera Kaalae*, Vickie Caraway of University of Hawaii Department of Botany.

- **Guest Speaker.** The speaker for January was Diana King, Hawaii Nature Center, speaking on "Environmental Education in Hawaii Today.."

February Meeting

- The February 2, 1998 meeting of the Hawaiian Botanical Society was called to order by Mindy Wilkinson, President. One guest was announced.

- The minutes were approved as read.

- **Treasurer's Report.** Ron Fenstemacher, Treasurer, reported $30 in expenditures in January, with no new balance available at this time.

- **Membership Report.** Gerald Toyomura, Membership Chair, proposed two new members to the Society..

- **Old Business**
  - The annual Botanical Society garage Sale will be held March 7th in Priscilla Millen's garage in Aina Haina. Members are encouraged to bring items for sale..

- **New Business**
  - There was an update from the Earth Justice Legal Defense Fund. On February 10th our motion was to be head before Judge Kay.

- **The Plant of the Month and Guest Speaker** were Adelheid Kuehnle (Horticulture) and Nathan Ewen (Patenting and Legal Rights). Their topic was "Development of new varieties of Anthuriums at UH.".

March Meeting

- The March 2, 1998 meeting of the Hawaiian Botanical Society was called to order Mindy Wilkinson, President. No guests were announced.

- The minutes were approved as read.

- **Treasurer's Report.** Ron Fenstemacher, Treasurer, reported a current balance of $4650 in the Botanical Societ's account.

• **Membership Report.** Gerald Toyomura, Membership Chair, reported there were 154 current members in the Society as of the end of February.

• **Old Business**
  • The gargae sale was scheduled to be held on March 7th at 144 Anue St. in Aina Haina. Donations were very welcome for items to be sold at the sale, and appreciation was expressed for all who have made donations already.
  • An update was given on the prospect of making a Hawaiian Botanical Society calendar. A typical one picture a month calendar would cost $5,000 to make, so it was suggested a calendar with one only picture be considered as an alternative.

• **New Business**
  • There was no new business.

• It was announced that a field trip to Kaena Point was scheduled to be held on March 21, and would be led by Aaron Lowe.

• **The Plant of the Month,** was given by Jan McEwen, Department of Horticulture, University of Hawaii, on akia, *Wikstromia uva-ursi.*

• **Guest Speaker.** The speaker for March was Rick Meinzer (Hawaii Agriculture Research Center) who gave a presentation on trainspiration from the upper canopy of a tropical rainforest

April Meeting

• The April 6, 1998 meeting of the Hawaiian Botanical Society was called to order Mindy Wilkinson, President. Two guests were introduced.

• The minutes were approved as read.

• **Treasurer's Report.** Ron Fenstemacher, Treasurer, reported that there is currently $5,212.50 in the account. The treasurer's report was approved.

• **Membership Report.** Gerald Toyomura, Membership Chair, reported there were 164 members in the Botanical Society. The question was raised as to what to do about honorary members who are deceased. It was suggested that further consideration of the matter is needed.

• **Old Business**
  • The Botanical Society garage sale did very well, bringing in nearly $500. A big thanks was extended to Priscilla Millen for donating use of her garage, to all members who donated items for the garge sale, and Vickie Caraway and others for making arrangements for the sale.

  • The Science Fair Committee announced the winners of the science fair awards.

  • The Calendar Committee reported that it would cost $2,900 to produce 500 copies of a one-page calendar. It was suggested that further consideration be given to the idea of making a Botanical Society calendar, as it does not sound as if it will be very cost effective.

  • The Undergraduate Grants Committee announced that the final day for submissions will be May 15th, and the winner will be notified on June 15th. Final reports from last years winners will be given in November.

  • The joint lawsuit with the Earth Justice Legal Defence Fund was successful. There is now a mandate for critical habitats.

  • It is now legal to propagate listed native plants if they are garden grown, and not collected from the wild.

• **New Business**
  • At next month's Hawaiian Botanical Society meeeting a plant raffle will be held. Donations of plants are welcome.

  • The May field trip will be led by Dr. Charles Lamoureux, Director of Lyon Arboretum. The hike will be May 2nd along the Manoa Cliffs Trail, and species checklists will be distributed for the hike.

• **The Plant of the Month,** was given by Alvin Yoshinaga, UH Center for Conservation Research and Training, on *Cyanea/Rollandia*

• **Guest Speaker.** The speaker for April was Paul Scowcroft. His topic was "Using stands of *Acacia koa* to moderate the harsh environment of alien-dominated montane grasslands."

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NEWSLETTER OF THE HAWAIIAN BOTANICAL SOCIETY
C/O DEPARTMENT OF BOTANY
UNIVERSITY OF HAWAI'I AT MANOA
3190 MAILE WAY
HONOLULU, HI 96822